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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

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DENVER COLORADO 80202 2466

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Mr Steve Slaten
Department of Energy
Rocky Flats Office
P O Box 928
Golden Colorado 80402 0928

RE Operable Unit No 1 Draft Corrective Measures Study /
Feasibility Study (CMS/FS)

Dear Mr Slaten

The above referenced report has been reviewed by EPA and its contractor PRC. Our combined comments have been assembled and are enclosed for your use in revising this document. Major revisions will need to be made to the document due to the incorrect premise that DOE used in regards to the applicable chemical specific regulations. This is unfortunate and could have been prevented if DOE had responded in a more timely manner to the agencies' repeated requests for meetings to resolve the ARARs issues. Since this is a fundamental issue that must be resolved before proceeding with revisions to this document, it is again imperative that the agencies meet as soon as possible to resolve this issue. EPA believes that Colorado Ground Water Standards are applicable and that there are reasonable remedial alternatives that can be used to achieve compliance with these standards in a fairly cost effective manner.

If you have any questions concerning these matters please
contact Gary Kleeman of my staff at 294 1071

Sincerely

Mark Hermark

Martin Hestmark Manager
Rocky Flats Project

Enclosure

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cc Scott Grace, DOE
Zeke Houk EG&G
Tim Reeves AEI
Jeff Swanson CDH
Joe Schieffelin CDH

Reviewed for Addressee
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ADMIN RECORD



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

999 18th STREET SUITE 500
DENVER COLORADO 80202 2466

GENERAL COMMENTS

- 1 DOE has incorrectly concluded that State Groundwater Standards are not applicable to Rocky Flats This fundamental mistake will mean that much of this document must be rewritten in order to adequately assess compliance with this ARAR DOE has not presented full rationale with supporting evidence that would convince EPA that these standards are not applicable
- 2 In light of the above comment it is obvious that DOE s preferred alternative of institutional controls will not achieve compliance with State Groundwater Standards Therefore one of the other alternatives that will remediate groundwater must be chosen as a preferred alternative Since the french drain and treatment plant are already in place it seems that there is much advantage to utilizing both of these components and optimizing this system through added enhancements in order to reduce the remediation time frame As such it may be necessary to consider other modifications to the alternatives already presented such as the use of surfactants horizontal wells etc It is also necessary to more thoroughly and accurately evaluate the effectiveness and cost of the french drain and treatment plant factoring in the discontinued collection of 881 footing drain water
- 3 The FS states that the preferred alternative for OU1 is institutional control without the french drain but with groundwater monitoring Under this strategy chlorinated solvents in the subsurface will continue to contaminate groundwater until sources diminish through natural processes However due to some uncertainty regarding the location and nature of the sources it is difficult to determine with confidence how long institutional controls and groundwater monitoring will be required Modeling results presented in the FS indicate that concentrations at Woman Creek will continue to increase until the year 2369 or for 375 years into the future To ensure that Woman Creek is protected it follows that groundwater monitoring will be required as long as concentrations increase but only 30 years of monitoring is accounted for in the cost estimate for the preferred alternative
- 4 The source removal remedial alternatives offer the possibility of removing source areas and potentially reducing the post-closure monitoring period and the potential for future corrective action Therefore the time required to reach remedial action objectives (RAOs) is one of the major difference among the three general types of alternatives evaluated (monitoring containment, and source removal followed by residual contaminant containment and monitoring) The FS must evaluate the time element in more detail before a remedial alternative is recommended The report must also provide more discussion about the uncertainty of the source extent and how this uncertainty affects the effectiveness of the source removal technologies These discussions must also consider the degree of confidence gained after the proposed soil gas study is conducted In addition the FS must estimate the time it will take to reach a point when monitoring is no longer required for each alternative and incorporate these results into the comparative analysis The FS must also consider the uncertainty associated with the models when evaluating the effectiveness of the various strategies Finally the FS should incorporate a sensitivity analysis into the model results to further evaluate the impact of subsurface contaminant uncertainty
- 5 Given the proximity of OU1 to Woman Creek one of the primary functions of any remediation that occurs at OU1 should be to protect Woman Creek and the associated

ecological receptors. Therefore protecting ecological receptors associated with Woman Creek must be an RAO for OU1

- 6 It is uncertain whether Woman Creek and the associated ecological receptors will be protected under the proposed remedial alternative. Throughout the FS the text states that maximum contaminant levels (MCLs) need to be met only at Woman Creek to be protective. It is not clear whether MCLs will protect ecological receptors associated with Woman Creek. The FS must be revised to illustrate how Woman Creek ecological receptors will be protected from OU1 contamination.
- 7 More detailed discussion about the proposed monitoring plan must be added to the FS particularly since monitoring is one of the primary features of the preferred alternative and is common to all alternatives. The alternatives that would suspend french drain operations but leave it in place (Alternatives 0 and 1) imply that monitoring will continue and that the french drain will be reactivated only if monitoring results exceed predicted values. The only locations for which predicted values are given in Appendix B are both down gradient of the french drain. The text does not specify which monitoring wells correspond to these locations. Regardless, by the time concentrations begin to exceed predicted values down gradient of the french drain, it may be too late for the french drain to be effective. If a contamination front is detected below the french drain, it is probable that the contaminants have already spread throughout the length of the french drain. Monitoring wells that will be used to trigger remedial decisions should be located above the portion of the french drain that intersects the expected contaminant flow path. Currently, the closest well above the french drain along the assumed contaminant flow path is well 0487, which was reported to have 9,500 micrograms per liter ($\mu\text{g/L}$) of trichloroethene (TCE), 2,600 $\mu\text{g/L}$ of carbon tetrachloride, and 590 $\mu\text{g/L}$ of tetrachloroethane (PCE) from a sample collected in late 1992. On the basis of these results, french drain operation should not be discontinued under any of the alternatives. If future wells are planned for the area above the french drain, investigative methods should be used that will optimize the well location with respect to bedrock topography and the contaminant plume.
- 8 There is no mention in this document of the buried gas transmission line that crosses OU 1 in an east-west direction between 119 1 and the French Drain. The existence of this feature could certainly impact some of the alternatives discussed in this document. Additionally, since this line lies in the path of migrating contaminated ground water, an evaluation of how it might be affecting migration is needed.
- 9 This report fails to make use of all available and pertinent data, and this is especially critical in the ground water modelling that was performed. Apparently only analytical data from 1990 through mid 1992 was used in the modelling, even though data from 1987 to the present is readily available for this purpose. Nor were the soil gas survey results from December 1993 mentioned or presented, although a much older (pre-1987) soil gas survey was cited a few times in the text. What happened to the cores and associated data that were proposed in the OU 1 Treatability Study Work Plan: Soil Flushing, Biotreatment, and Radio Frequency Heating, September 1992? That work plan was designed for the purpose of collecting site specific data to be used in evaluating alternatives for the OU 1 CMS/FS, and any data that was collected must be presented in this report.

SPECIFIC COMMENTS

- 1 Executive Summary, Page 11, First Paragraph The paragraph summarizes OU1 media and associated risk. The text states that surface soil risks already fall within an acceptable risk range and that surface soil hot spots are being addressed through a proposed action memorandum (PAM). The inference that OU 1 surface soil risks are already acceptable is premature and must be deleted. BRA results for subsurface soils, however, are not summarized and the necessity for remediation is unclear. The summary should describe how all media will be addressed, including the agreement that OU 1 surface soils will be fully evaluated with OU 2 surface soils in the OU 2 CMS/FS.
- 2 Page 1 21, Section 1.3.3 The section states that sources of polynuclear aromatic hydrocarbons (PAHs) at OU1 are presumed to be from general urban fallout including asphalt dust, vehicle exhaust, and furnace exhaust. The text must discuss whether similar PAH levels are found at other OUs to substantiate this conclusion.
- 3 Page 1 21, Section 1.3.4 This section states that occurrences of polychlorinated biphenyls (PCBs) are restricted to IHSS 119 1 and 119 2 and that the contaminant release mechanism is unknown. Figure 1.7 shows the highest PCB concentrations occurring at or near IHSSs 119 1, 119 2, and 106, as well as lower concentrations in surrounding areas. This figure suggests that PCBs are not restricted to the two IHSS areas and that some type of contaminant transport may have occurred. Are the blue symbols that depict concentrations between 10 and 100 ug/kg actually non-detects? Discrepancies between the text and figure must be corrected.
- 4 Page 1 24, Section 1.3.5 This section discusses plutonium, americium, and uranium contamination. A figure that summarizes the extent of plutonium/americium contamination is provided; however, a figure for uranium is not. A figure summarizing the extent of uranium contamination should be added.
- 5 Page 1 28, Second Paragraph This paragraph states that an aqueous phase hydrocarbon plume in groundwater has the potential to discharge to Woman Creek, although it is not likely due to the low initial volume of contaminants of concern (COC) available for transport. The text must specify what COC volume will cause a potential discharge to Woman Creek. In addition, it is not clear whether the potential presence of dense nonaqueous phase liquids (DNAPLs) in the subsurface allows adequate estimates of initial COC volumes to be made. Therefore, the uncertainty associated with stated conclusions must be discussed. Uncharacterized high concentration zones in the OU1 subsurface must be considered when making decisions based on the amount of contaminants available for transport.
- 6 Page 1 30, First full paragraph It states here that the surface soils at OU 1 have a high carbon content. On page 1 28, first paragraph, it is stated that the soils at OU 1 have relatively low organic carbon content. This contradiction must be explained or corrected.
- 7 Page 1 36, Section 1.5.2 This section summarizes the environmental evaluation (EE). It is not clear if the EE evaluated potential OU1 impacts to Woman Creek. Even though Woman Creek is part of OU5, OU1 contamination can migrate to Woman Creek and potential environmental impacts must be assessed. Ecological risks from OU1 contaminants to Woman

Creek must be assessed and summarized in the FS so that appropriate remedial alternatives can be evaluated and selected

- 8 Page 2-4, Section 2.2 This section presents RAOs. None of the RAOs address protecting ecological receptors in surface water and sediment of Woman Creek. Protecting ecological receptors at Woman Creek must be added as a RAO. Even though Woman Creek is part of OU5, OU1 contamination can migrate into Woman Creek. Therefore, OU1 remedial alternatives must address associated sources and exposure pathways.
- 9 Page 2-6 and 2-7, Current Ground Classification This section presents some of the criteria from 5 CCR 1002-8, Subsection 3-11-4 used by the Colorado Water Quality Control Commission (CWQCC) to classify domestic (or agricultural) use quality groundwater. However, one criteria was not presented and the regulation is worded such that only one of the criteria need be met in order to allow such classification to be made. The missing criteria is that the background levels are generally adequate to assure compliance with the Human Health Standards (or Agricultural Standards) listed in Table 1 (or Table 3) and TDS levels are less than 10,000 mg/l. The standards listed in the referenced tables are generally higher than background levels for groundwater at Rocky Flats and therefore the CWQCC classification for the Quaternary and Rocky Flats aquifers meets its established criteria. The whole question of classifying the groundwater as being domestic use quality only determines which set of CWQCC standards apply, and has no bearing on the CWQCC organic standards which include standards for the primary contaminants in OU 1 groundwater. 5 CCR, 1002-8, Subsection 3-11-5 states "The (organic) standards specified in Subsection C apply to all State ground waters." These organic standards as applicable to OU 1 are listed in Table 2-2, page 2-10 of this document. It should be noted that the (PQL) listed for a chemical is used as the performance standard whenever it is greater than the listed standard for that chemical.
- 10 Page 2-7, Section 2.3, First Paragraph This section attempts to provide the basis for which DOE disagrees with the CWQCC conclusion that groundwater beneath OU1 could be used as a drinking water supply. The text states included in the Phase III RCRA Facility Investigation/Remedial Investigation [RFI/RI] report are water production capability simulations and well production tests which conclude that neither the Rocky Flats Alluvium nor the Arapahoe Aquifers beneath OU 1 is capable of producing sufficient water for even domestic purposes. Actually both this report and the RFI/RI Report have only water production simulations for the colluvium, not the Rocky Flats Alluvium and Arapahoe Aquifers. OU1 Technical Memorandum Number 6 (EG&G 1992) included simulations of the water production capabilities of the Rocky Flats alluvium and Arapahoe sandstone. The state engineer's office was asked by DOE to review the findings presented in TM #6 and responded that the conclusions were valid but qualified this response by stating that the specified yield used in the Arapahoe Aquifer simulation was incorrect and should be reduced from 0.30 to a value of between 0.15 and 0.20. The state engineer's office stated that the use of the higher value in the model will release more water from storage and cause a more rapid depletion. Although the state engineer's office believed it would not significantly change the conclusion, it suggested the model be rerun with a specific yield of no more than 0.20. The Arapahoe Aquifer simulation, however, was not resubmitted along with the colluvial simulation in either the Final Phase III RFI/RI (EG&G 1994a) or the current document. The

text must clarify state which simulations have been included in this document and in the Final Phase III RFI/RI

- 11 Page 2 9, First Paragraph The last sentence in this paragraph says that Colorado groundwater standards are not assessed as ARARs because the classifications requiring those standards have not been applied consistently throughout the state As discussed in comment #8 the classification specified by the CWQCC does not have any affect on organic standards for ground water in the state of Colorado Even if this were the case merely making this statement without any supporting examples and documentation to show this alleged inconsistency or lack of general applicability is inadequate
- 12 Page 2 16 Why does this section focus only on the contaminated ground water beneath a specific portion of IHSS 119 1? Quantities of ground water requiring remediation must also be estimated for other important areas within OU 1 south of Building 881 and south of IHSS 119 2
- 13 Page 2 17, Second full paragraph Why were estimates of contaminated ground water made from saturated thickness maps that represent the lowest ground water levels or the smallest volume of ground water? Estimates of maximum saturated thickness must also be used in making estimates
- 14 Page 2 25, First Paragraph, Page 2 29, Last Paragraph Contrary to what is stated here the Building 891 water treatment system has not been proven to be completely effective For the most part the water that has been treated has had very low levels of contaminants due to the diluting factor of the footing drain water from Building 881 On the occasions that higher concentrations of carbon tetrachloride were put through the system treatment effectiveness was poor for this chemical, (see the Quarterly Report for OU 1 IM/IRA for April through June 1994) The data in this report also raises some questions regarding treatment of acetone and chloroform Generally however TCE and PCE have been effectively treated by this system Therefore this is a promising treatment process for some contaminants but further evaluation and probable modification is needed before it is completely proven effective As a result the statement regarding effective treatment must be revised
- 15 Page 2 25, Second Paragraph Soil flushing could be an attractive remedial alternative at OU1 especially because a down gradient groundwater containment and extraction system is already in place However the paragraph states that process options that require injection of additional fluids into the subsurface such as soil flushing were not favored because they may force contaminants farther into the bedrock system This rationale is not adequately developed to screen out soil flushing Any effects resulting from additional contaminant migration into bedrock must be discussed Also the degree of migration expected into the bedrock system must be evaluated and compared to the increased rate of migration toward the french drain that could be achieved through soil flushing Therefore soil flushing and/or the use of surfactants must be more completely evaluated as options that could be incorporated to the existing french drain system to hasten the amount of time needed for remediation
- 16 Page 2 27, Second Paragraph This sentence should probably list the Building 881 footing drain sump pump instead of Building 891 sump pumps as being original components of the IM/IRA system

- 17 Page 3 3, Table 3 1 This table identifies the components of each of the eight (0-7) remedial alternatives. Institutional controls are not listed as part of the four source removal alternatives (4 through 7). The text must clarify whether institutional controls are required during the post-closure monitoring period. Institutional control should be considered because of the high degree of uncertainty associated with DNAPLs and since residual contaminants could still be present and migrate after the source is removed. Institutional controls will likely be required as long as monitoring is required for the alternatives to be protective of human health and the environment.
- 18 Pages 3-4 and 3 5, Sections 3.2.1 and 3.2.2 These two sections discuss alternatives 0 and 1 and suggest that the french drain should be decommissioned while implementing groundwater monitoring and institutional controls. The sections must be clarified to state that the french drain will be left in place until groundwater monitoring and institutional controls are no longer needed. Groundwater monitoring is needed to determine if any changes in contaminant concentrations or migration patterns occur. If changes occur, it is possible that corrective action may be required. Therefore, the french drain should be left in place for as long as monitoring is required so that if future corrective action is required under Alternatives 0 or 1, it will be available for use.
- 19 Pages 3 10, 3-15, and 3-23, Sections 3.2.5, 3.2.6, and 3.2.7 These sections describe soil vapor extraction (SVE), thermally-enhanced SVE, and hot air injection with mechanical mixing. The text states that a soil gas study will be conducted before implementing these alternatives to assist in locating source areas. Actually, a limited soil gas survey was performed at thirty locations in 119 1 in late December 1993. The results of this survey should have been included in this report and must be a part of the final CMS/FS. These results give a better indication of where existing sources are located and also confirm that at least two different release points that leaked different types of solvents occurred within the former drum storage area. Additionally, cone penetrometer testing (CPT) should also be considered prior to implementation in order to provide information about bedrock topography which could assist in locating areas with DNAPL.
- 20 Page 3 12, First Paragraph This paragraph discusses COCs that are recoverable through SVE. The text states that all COCs under consideration are amenable to SVE. However, previous sections of the report identified inorganic contamination at OU1 that is not amenable to SVE. This discrepancy must be clarified.
- 21 Page 3 12, 3 22, 3 26, and 3 29 These pages describe how the french drain will be incorporated into source removal alternatives. The text states that once the source removal systems are decommissioned, operation of the french drain will be suspended. It is not clear why french drain operation would be suspended given the high degree of uncertainty associated with DNAPL locations and because contaminants in a dissolved phase could still be present and migrate. The french drain and treatment plant are currently in place and, given the probable low additional cost, should be considered as a means to accelerate cleanup of residual groundwater contamination. Use of the french drain and associated treatment plant could accelerate cleanup, reduce the post-closure monitoring period, and protect Woman Creek from OU1 contamination.

- 22 Page 4-11, Second Full Paragraph The text states that conceptual models were used to predict future COC concentrations at Woman Creek. It is not clear if concentrations are predicted in Woman Creek at the upgradient boundary of Woman Creek or some distance upgradient of Woman Creek. The text must clarify where concentrations are predicted.
- 23 Page 4-12, Groundwater Modeling The modeling predicts maximum concentrations occurring in approximately 160 years for the remediation scenario. The modeling presumably assumes that the french drain will be decommissioned after the source control measure is implemented. As stated in Comment 18, the french drain will likely continue to operate and the model should take this into consideration for the remediation scenarios.
- 24 Pages 4-11 through 4-12, Section 4.2, Groundwater Modeling This section describes the groundwater modeling conducted to assess whether MCLs would be met at Woman Creek under three types of remedial action scenarios. The groundwater model used is not suitable for this analysis because it is poorly documented and in some ways it is not conservative. The groundwater model does not contain enough information on model calibration and the model's sensitivity to input parameters (sensitivity analysis) that is needed to assess the credibility of a predictive model. The groundwater model is not conservative for two reasons. First, the model did include TCE, which is the VOC present in the greatest concentration at IHSS 119-1 and for which the groundwater standard is 5 ug/L. Second, the model calibration data set did not include the highest observed VOC concentrations at well 0487 (fourth quarter 1992) which are generally an order of magnitude higher than the maximum values included in the calibration data set. The groundwater model should either be rerun with the above-mentioned deficiencies corrected or compliance with ARARs should be assessed on some other basis.
- 25 Page 4-12, Last Three Bullets The peak PCE concentrations are shown here as being 5 ug/L for remediation alternatives but only 0.0862 ug/L for the french drain alternatives. How can remediation that is assumed to remove the source result in greater concentrations of this contaminant? This must be reviewed and corrected or explained. It would be much simpler and clearer to use ug/L as the unit of measure in all text, tables and graphs when referring to concentrations of organics.
- 26 Page 4-14, 3rd Full Paragraph The text states that the no action alternative would be protective of human health and the environment based on exposure to COCs at Woman Creek. The text must also state that the no action alternative will not prevent groundwater ingestion or inhalation of VOCs and will therefore not be protective of human health and the environment based on exposure to groundwater.
- 27 Section 4.2, Detailed Analysis of Alternatives Throughout the detailed analysis of alternatives, the text states that MCLs will be met at Woman Creek. It is not clear whether MCLs are protective of ecological receptors at Woman Creek. The text must state chemical concentrations at Woman Creek that would be protective to ecological receptors.
- 28 Page 4-33, Fourth Paragraph The text does not give an estimate for the time that alternative #3 would take. Since the O&M cost used in this alternative is the same as in the previous alternative, DOE must be assuming that the same amount of time is involved. The addition of

properly located extraction wells would certainly decrease the amount of time needed to remediate and as a result the overall O&M cost should also be decreased. Estimation of decreased time and cost must be made for a better evaluation of this alternative.

- 29 Page 4-37, First Full Paragraph The remediation time frames stated here need to be reviewed and corrected since conflicting time estimates are given here on page 4-38, page 4-43 and in the cost estimate appendix. The overall time given on this page is two years but four years is attributed to soil vapor extraction alone. Also the six months estimated for a soil vapor survey seems to be much longer than necessary.
- 30 Page 4-51, Figure 4-2 The description of Alternative #6 and referenced figure indicate that it would treat a much smaller area than Alternatives #4 and 5. In order to accurately compare these alternatives it would make more sense to compare treatment of the same actual areas. In addition it is stated that dewatering for Alternative 6 will take only about five days whereas 60 to 80 days is estimated for Alternative 4 which is roughly 2.5 times larger but would use two additional wells. These estimates do not seem comparable and both must be reevaluated.
- 31 Page 4-56, Section 4.2.7 This section discusses effectiveness of Alternative 6 hot air injection and mechanical mixing. The ability of the drill rig and cutting/mixing blade to operate in colluvium and bedrock must be discussed. This potential limitation would reduce this alternative's effectiveness in removing DNAPL. In addition since this is not a commonly used technology this section must discuss how successful it has been in similar situations to give some indication of the degree of certainty that this alternative would prove successful.
- 32 Page 4-60, First Three Paragraphs The text states that excavated soils will require pretreatment to meet land disposal restrictions for each constituent and lists treatment standards for chlorinated hydrocarbons. Metals and radionuclides will also be present in the soils. The text should clarify whether these constituents will require pretreatment also. Furthermore the text states that a thermal desorber will be used to treat excavated soils and that soils will be packaged and shipped to a licensed facility. Thermal desorption will not treat metals or radionuclides in soils. The text must be clarified to state whether these soils will require further treatment or indicate whether the facility will accept low level radionuclide-contaminated soils.
- 33 Page 4-62, Last Complete Paragraph It is stated here that excavation of the source area would be the most effective way to remove DNAPLs. However at the present time the exact location of any DNAPLs is unknown and therefore this excavation could quite possibly miss the source. In order to better define the possible location of DNAPLs a soil gas survey is also needed for this alternative.
- 34 Page 4-73, First Full Paragraph The text states that risk levels are slightly higher for the four source removal alternatives because under these scenarios the french drain would be decommissioned as soon as the source is remediated. The text then states that decommissioning would allow low concentrations of contaminants to continue to migrate away from OU1. As stated in Comment 18 the french drain could continue to operate following

the source removal with potentially little additional cost. The alternatives must be reranked considering the continued operation of the french drain.

- 35 Page 4-74, Section 4.3.2 The text states that all alternatives comply with chemical specific ARARs identified for OU 1. As previously stated, this document has not correctly identified the chemical specific ARARs for OU 1. State groundwater standards are applicable, and are not merely standards to be considered. Therefore, all alternatives must be completely re-evaluated to determine whether or not they will comply with these chemical-specific standards. In addition, the point of compliance for these regulations would most likely be the down gradient side of the french drain. This document never explicitly states why Woman Creek was chosen as the point of compliance, but it is clearly not appropriate in view of the ARARs identified in these comments. As a result, this section and all previous sections pertaining to this issue must be revised accordingly.
- 36 Page 4-75, Section 4.3.3 This section compares long term effectiveness among alternatives. Alternatives 4, 5, 6, and 7 are all described as having equal effectiveness. However, Alternative 5 would theoretically be more effective than Alternative 4 in source remediation due to the thermal enhancement. In addition, Alternative 6 is likely to be more effective than either Alternative 4 or 5 since Alternative 6 employs mechanical mixing to overcome limitations imposed by fine-grained soils. Soil permeability will likely limit the effectiveness of Alternatives 4 and 5. Alternative 7 likely will be the most effective as contamination will be actively excavated, treated, and disposed. Alternatives should be ranked to reflect strengths and shortcomings so that adequate comparisons can be made.
- 37 Page 4-76, Section 4.3.3 This summary and comparison of each alternative's ability to reduce toxicity, mobility, and volume through treatment concludes that alternative 7 excavation would be most effective. Nevertheless, this is the only alternative that as written would require off site disposal of large volumes of soil (estimated at 22,630 cubic yards). Therefore, this alternative may be viewed as being more effective because it involves less uncertainty of success, but in the end, it is the worst in terms of volume reduction for disposal. The degree of certainty of success is actually more appropriately evaluated in the previous section, long term effectiveness and permanence. As a result, Alternative 7 should probably be ranked between Alternatives 3 and 4 for this criterion instead being the best of all alternatives.
- 38 Page 4-77, Section 4.3.5 This section evaluates short term effectiveness on the basis of short term risks to the community and workers, as well as impacts to the environment. The evaluation does not consider remediation time-frames that are required to reach RAOs. The NCP and EPA guidance state that short-term effectiveness is also assessed on the basis of time required to reach RAOs. Time to remediate is a major difference among alternatives; therefore, the alternatives should be reranked considering this criterion.
- 39 Page 4-78, Implementability Ranking The text states that Alternative 0 is the most implementable. However, the ranking indicates Alternative 2 is the most implementable. The text should clarify this discrepancy and rank Alternative 0 first and Alternatives 1 and 2 second.

40 Page 4-78, Section 4.3.7 The text states that Alternatives 2 and 3 are significantly more costly than the other alternatives due to the high cost of operation and maintenance (O&M) for the Building 891 treatment system for 30 years EPA does not agree with the cost estimates for Alternatives 2 and 3 due to the following four factors

1) Actual subcontractor costs for the 891 Treatment Plant for the past year (July 1993 June 1994) have totalled \$208 000 in comparison with \$676 000 that is allotted for the same item in the detailed cost estimate shown in Appendix E

2) A much smaller volume of water from OU 1 will be treated once the 881 footing drain flow is no longer collected further reducing this annual cost

3) As stated on Page 1 37 the plant will likely be converted for sitewide use The additional O&M costs required resulting from OU 1 should be used in the cost estimate not the total plant O&M cost if this is the case

4) Finally the basis for estimating operation of the 891 Treatment Plant for 30 years was not provided in the document It does not appear that a thorough evaluation was performed using existing data and groundwater modelling to estimate the amount of time to remediate that each of these alternatives using the french drain would require

Considering all of the above factors O&M costs must be re-estimated for Alternatives 2 and 3 and the alternatives must be reranked

41 Page 4-78, Section 4.3.7 This section presents capital O&M and post-closure costs All eight alternatives have approximately equal post-closure monitoring costs assuming a 30 year postclosure period The analysis should consider that the alternatives will likely have vast differences in monitoring periods The source removal alternatives should have a considerably shorter time frame since sources are removed and groundwater contaminant concentrations should decrease much more rapidly Conversely it is likely that Alternatives 0 1 2 and 3 will require monitoring for much longer than 30 years because of the continued contaminant release from the DNAPL sources Modeling could help to determine how long monitoring will be required for each alternative and costs should be estimated accordingly

42 Section 4.4.1, Page 4-80, Paragraph 3 The text states that under the preferred remedial action alternative the french drain would not be actively pumped but instead would be maintained and monitored as a contingency in case groundwater contaminant concentrations begin exceeding predicted values A groundwater sample collected at well 0487 during fourth quarter of 1992 contained approximately 2 600 $\mu\text{g/L}$ of carbon tetrachloride, which exceeds the calibrated carbon tetrachloride source concentration of 640 $\mu\text{g/L}$ Although predicted values of carbon tetrachloride are not specified in the modeling report, this observed result logically exceeds any simulated result that could be calculated for well 0487 It also indicates that it is probably only a matter of time before levels of carbon tetrachloride will greatly exceed predicted values down gradient of the french drain if the drain is turned off Because there are no other monitoring wells along the contaminant flow path between well 0487 and the french drain it follows that the preferred alternative requires continued pumping of the french drain and the contingency plan mentioned in the text appears to already have been triggered

- 43 Page 4-80, Section 4.4 The text states that Alternative 1 is the preferred alternative based on the results of the comparative analysis. However, as stated in comments above, several conclusions in the comparative analysis do not appear to be accurate due to the necessity of re-evaluating all of the alternatives using corrected assumptions and more thorough analysis.

APPENDIX B GENERAL COMMENTS

- 1 Contaminant concentration data used to calibrate the transport model are not representative of the range of VOC concentrations observed at well 0487. Calibration values are limited to samples collected between first quarter 1990 and second quarter 1992. Maximum values of 73 $\mu\text{g/L}$ of PCE and 330 $\mu\text{g/L}$ of carbon tetrachloride were detected during this period. A sample collected during fourth quarter 1992 contained 590 $\mu\text{g/L}$ of PCE and approximately 2,600 $\mu\text{g/L}$ of carbon tetrachloride. These data were available at the time the modeling was conducted (summer 1994). The omission of high observed values from the calibration data set results in an underestimated source strength. For instance, the calibrated source concentration for carbon tetrachloride (640 $\mu\text{g/L}$) is an order of magnitude lower than the maximum observed concentration at well 0487. Therefore, the model is not conservative with regard to source strength. The high VOC values detected in fourth quarter 1992 should be incorporated into the calibration data set.
- 2 TCE was not included in this modeling study even though it is a contaminant of ground water at OU1 and is suspected of being present as a DNAPL at IHSS 119.1. TCE has been detected in samples from well 0487 at a concentration of 9,500 $\mu\text{g/L}$. TCE should be included in the modeling study because it has been detected in higher concentrations than the other VOCs in the modeled area.
- 3 A significant source of uncertainty in the model results is the source location. The text on page B.2 states the release mechanism to groundwater is dissolution of the residual (immobile) DNAPL phase. This residual DNAPL is assumed to be located just upgradient of well 4387. The model does not account for the possibility that mobile DNAPL has moved away from the area near well 4387 and is still mobile or exists as an immobile pool some distance from well 4387. A mobile DNAPL could account for the sudden increase in TCE, PCE, and carbon tetrachloride in samples at well 0487 during fourth quarter 1992. Although these concentrations are below 1 percent of solubility (the level usually cited as being indicative of a DNAPL), the bedrock topography in the vicinity has not been mapped in sufficient resolution to indicate whether well 0487 is in the center of the channel-like bedrock surface feature that is believed to provide a preferential groundwater flow path. The two options for dealing with this uncertainty are further characterization (CPT or geophysics to map the orientation of the bedrock surface feature and a soil gas survey to map high VOC concentrations) or modeling numerous source configuration scenarios that incorporate potential DNAPL movement.
- 4 The model simulates future contaminant trends at two locations: down gradient of the French drain and at Woman Creek. The text and a figure should specify exactly where these points are related to the model grid by listing the depth and x-y coordinates of each location. The text is especially vague regarding the Woman Creek location and whether it is at the surface or a specific depth below the surface. Contaminant concentrations may be different at the

bottom of the valley fill alluvium than in Woman Creek proper. The text should specify the locations of the simulated contaminant trend plots relative to the model grid, and include trend plots simulated in the lower portion of the valley fill alluvium if this has not already been done.

- 5 The model documentation lacks three components that are generally considered essential to any modeling study: (1) discussion of calibration methodology including calibration values and calibration statistics (individual and lumped); (2) a sensitivity analysis; (3) the simulated water budget (Anderson and Woessner 1992, DHS 1990). The water budget should include a discussion of whether simulated boundary fluxes (French drain, pumping well, Woman Creek) are representative of site conditions. At a meeting with PRC and the Colorado Department of Public Health and the Environment (CDPHE) in July 1994, Dames & Moore and EG&G indicated that there would not be a formal sensitivity analysis due to time constraints. PRC and CDPHE requested that at least a qualitative description of the effects of varying key parameters and boundary conditions be presented in the document. Although some of this information may be submitted soon as the result of a meeting held on Sept. 27, EPA has not yet received the submittal. The information listed above is necessary to assess whether the model is a credible representation of the groundwater system and contaminants' behavior and if the model is a reasonably unique solution. Without this information, the model should not be used for evaluating remedial options.

APPENDIX B SPECIFIC COMMENTS

- 1 Page B 1, Fourth Paragraph. The text states "groundwater flow tends to be focused in areas where the colluvium is thickest, these areas generally correspond to surface-water drainage features. Such correspondence is likely due to deeper weathering of bedrock beneath surface channels. Data have not been presented to substantiate this conclusion. Gravity rather than surface water is generally considered to be the primary transport mechanism for colluvial deposits. The Final Phase III RFI/RI (EG&G 1994a) suggests that slumping is the predominant geomorphic agent on the hillside and that hydrologic features such as seeps correspond to slump block boundaries. Figure 3-27 of the RFI/RI depicts a slump block boundary at the approximate location of the surface drainage below IHSS 119.1. The drainage apparently formed after movement of the slump block; therefore, any weathering of geologic materials below this drainage is probably restricted to a relatively shallow zone within the colluvium. Furthermore, the French drain cross-section panel drawings included with the Phase III RFI/RI show no correlation between soil type (sand, silt, clay) and bedrock topography as would be expected with fluvial deposits. Although flowing water may have incised channels into the bedrock surface during a period of uplift and erosion, the bulk of the surficial deposits appear to have been formed by colluvial processes. Therefore, it seems unlikely that the location of the surface drainage is related to colluvial thickness or variations in the bedrock surface. The interpretation that the thickest surficial deposits are found below surface drainages is not supported by data and must be deleted from the text. This interpretation is used to suggest that the well network below IHSS 119.1 and the groundwater model cross section are aligned along the axis of the preferential groundwater pathway. Data on bedrock topography and plume configuration are not extensive enough in this area to support this conclusion.

- 2 Page B 2, First Paragraph The text implies that the Rocky Flats alluvium has a low permeability because it was derived from the claystone and siltstone of the bedrock. The Rocky Flats alluvium is an alluvial fan deposit with its apex at the mouth of Coal Creek Canyon. Although lower portions of the Rocky Flats alluvium may incorporate some reworked bedrock, it is primarily composed of coarse alluvium (sand, gravel, and cobbles) that was deposited by Coal Creek. The permeability of the Rocky Flats alluvium is highly variable. The origin and general characteristics of the Rocky Flats alluvium must be correctly stated in the text.
- 3 Page B 7, First Paragraph The text describing the simulated concentration contours for PCE in 1993 and 1994 (Figures B 20 and B 21) states: after 24 years, the french drain and extraction well have a slight effect on the plume. The french drain, however, has only been in operation since 1992. The statement must be clarified to indicate the length of time the french drain and extraction well have been operating in the simulation.
- 4 Table B-4 This table does not list source location or source strength as an uncertainty factor, although the source location is not presently known and source strength is estimated from the model calibration. Virtually every uncertainty factor listed in the table is attributed a low degree of uncertainty, often with no other rationale than the model is generally conservative. However, the model does not reproduce high VOC concentrations detected in samples at well 0487 during fourth quarter of 1992; therefore, it should not be considered conservative. The table should address source location and source strength as uncertainty factors and provide specific rationales why the uncertainty factors are attributed low degrees of uncertainty. Most modeling studies describe uncertainty quantitatively with a sensitivity analysis. Lacking this essential component, a modeling study must describe sources of error and uncertainty as thoroughly as possible.
- 5 Figure B 13 Figure B 13 shows the simulated carbon tetrachloride contaminant trend plot at well 0487 for the calibration period and identifies the minimum, average, and maximum observed values at well 0487. The simulated values appear to be barely above zero and below the minimum observed value at the end of the calibration period. It is implied in the document (though not clearly stated) that contaminant source strength was calibrated by trial-and-error matching of simulated concentrations with observed concentrations at wells 4387 and 0487. It is unclear how the carbon tetrachloride source value of 0.64 milligrams per liter (mg/L) was calibrated based on this plot. The calibration process should be explained in the text and the calibration values, targets, and criteria should be clearly stated. Carbon tetrachloride values should be recalibrated using the full range of data and the source strength for carbon tetrachloride should not be considered to be calibrated unless it meets stated calibration criteria. Calibration values (field measured concentrations), targets (values plus associated error), and criteria (allowable error) must be stated to allow the calibration to be assessed (Anderson and Woessner 1990).
- 6 Figures B-18 through B 54 All of these figures, most of which are breakthrough curves, need to be labelled to indicate the alternative or set of alternatives for which they apply.
- 7 Figures B 22, B 33, and B-44 Section 7 of the text states that these three figures depict the simulated PCE concentration contours in the year 1998 that would result from the three general types of remedial responses (no action, groundwater containment, source removal).

The title blocks of the figures give different elapsed times than does the text 146 000 days (the year 2369) for Figures B 22 and B 33 and 73 000 days (the year 2169) for Figure B-44. These contradictions must be corrected.

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- California Department of Health Services (DHS) 1990 Technical Standards for the Mathematical Modeling of Ground Water Flow and Contaminant Transport at Hazardous Waste Sites Toxic Substances Control Program Program and Administrative Support Division Technical Services Unit July
- EG&G 1992 Operable Unit No 1 Technical Memorandum No 6 Public Health Risk Assessment Exposure Scenarios June
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- U S Environmental Protection Agency 1988 Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA Interim Final EPA/540/G-89/004 OSWER Directive 9355 3-01 October